CLAIMS

1. A method of monitoring the temperature of a transformer winding in a current probe wherein the current probe includes a magnetic core having a multi-turn winding disposed there-around forming a probe transformer and a Hall Effect device disposed within the magnetic core for generating a differential output signal for producing a current signal through the multi-turn winding, the method comprising:

determining an initial transformer temperature of the current probe as a function of the winding resistance of the transformer;

determining a relative temperature of the Hall Effect device as a function of resistance change of the Hall Effect device; and

combining the initial transformer temperature and the relative Hall Effect device temperature to produce a continuous transformer temperature indicative of the temperature of the transformer.

2. The method of monitoring the temperature of a transformer winding in a current probe as recited in claim 1 further comprising the step of removing the current signal from the multi-turn winding when the continuous transformer temperature exceeds a threshold temperature value.

3. The method of monitoring the temperature of a transformer winding in a current probe as recited in claim 2 further comprising the step of providing a visual indication when the continuous transformer temperature exceeds a threshold temperature value.

4. The method of monitoring the temperature of a transformer winding in a current probe as recited in claim 1 wherein the initial transformer temperature determining step further comprises the steps of:

storing the thermal coefficient of copper, α, an initial transformer temperature, T_0, and a termination resistance, $R_{termination}$, in memory;

generating digital values representative of an input voltage, Vin, to the multi-turn winding and an output voltage, Vout, from the multi-turn winding;

calculating an initial probe resistance, R_0, using the termination resistance and the digital values of the input and output voltages; and

calculating the initial transformer temperature, T_{probe}, using the function

$$T_{probe} = T_0 + \frac{1}{\alpha}\left(\frac{R_{termination}(Vin - Vout) - R_0\,Vout}{R_0\,Vout}\right)$$

5. The method of monitoring the temperature of a transformer winding in a current probe as recited in claim 1 wherein the relative temperature of the Hall Effect device determining step further comprises the steps of:

storing a thermal coefficient of resistance value of the Hall Effect device, α_H, a Hall Effect device bias voltage source value, V_{Bias+}, and a resistance bias value, R_{Bias}, in memory;

generating a digital value representative of a voltage, V_{Hall+}, across the Hall Effect device;

calculating an initial Hall Effect device resistance value, R_{Hall}, using the function $R_{Hall} = \left(\frac{2 \times V_{Hall+} R_{Bias}}{V_{Bias+} - V_{Hall+}} \right)$ and storing the resistance value in memory as $R_{Hall\ Init.}$;

generating additional digital values representative of the voltage, V_{Hall+} and calculating Hall Effect resistance values, R_{Hall}, representing changes in the resistance of the Hall Effect device as a function of temperature; and

calculating changes in temperature of the Hall Effect device, $\Delta T_{probeHall}$, using the function $\Delta T_{probeHall} = \frac{1}{\alpha_H} \left(\frac{R_{Hall} - R_{Hall\ Init.}}{R_{Hall\ Init.}} \right)$.

6. The method of monitoring the temperature of a transformer winding in a current probe as recited in claim 1 wherein the relative temperature of the Hall Effect device determining step further comprises the steps of:

storing first and second thermal coefficient of resistance values of the Hall Effect device, k_1 and k_2, a Hall Effect device bias voltage source value, V_{Bias+}, and a resistance bias value, R_{Bias}, in memory;

generating a digital value representative of a voltage, V_{Hall+}, across the Hall Effect device;

calculating an initial Hall Effect device resistance value, R_{Hall}, using the function $R_{Hall} = \left(\frac{2 \times V_{Hall+} R_{Bias}}{V_{Bias+} - V_{Hall+}} \right)$ and storing the resistance value in memory as $R_{Hall\ Init.}$;

generating additional digital values representative of the voltage, V_{Hall+} and calculating Hall Effect resistance values, R_{Hall}, representing changes in the resistance of the Hall Effect device as a function of temperature; and

calculating changes in temperature of the Hall Effect device, $\Delta T_{probeHall}$, using the function $\Delta T_{probeHall} = k_1 (R_{Hall} - R_{Hall\ Init.}) + k_2 (R_{Hall} - R_{Hall\ Init.})^2$.